WHAT IS CLAIMED IS:

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1. A resonant reflector for an optoelectronic device, the resonant reflector comprising:

a first material layer having a first refractive index, the first material layer having one or more patterned regions that extend down into the first material layer, selected patterned regions being filled with a second material having a second refractive index; and

a mirror positioned adjacent the first material layer, the mirror having an adjacent mirror layer with a third refractive index.

2. A resonant reflector according to claim 1, wherein the first refractive index is greater than the second refractive index, and the first refractive index and the second refractive index are less than the third refractive index.

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3. A resonant reflector according to claim 1, further comprising a second material layer having the second refractive index, the second material layer patterned to extend above the non-patterned regions of the first material layer.

4. A resonant reflector according to claim 1, wherein the one or more patterned regions reduce the reflectivity of the resonant reflector in those regions.

5. A resonant reflector according to claim 4, wherein the one or more patterned regions are positioned to provide mode control to the optoelectronic device.

6. A resonant reflector according to claim 1, wherein the one or more patterned regions extend all the way through the first material layer.

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7. A resonant reflector according to claim 1, wherein the first material is SiO2, the second material is Si3N4 or TiO2, and the top DBR mirror layer is AlGaAs.

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8. A resonant reflector according to claim 1 wherein the first material layer is a top mirror layer of the mirror.

9. A resonant reflector according to claim 1 wherein the first material layer is provided on top of a top mirror layer of the mirror.

10. A method for forming a resonant reflector for an optoelectronic device, the optoelectronic device having a top mirror, the method comprising:

providing a first material layer above the top mirror;

etching a pattern in the first material layer, resulting in one or more patterned regions; and

providing a second material layer over the first material layer including over the one or more patterned regions.

11. A method according to claim 10, wherein the first material layer has a first refractive index, the second material layer has a second refractive index and the top mirror has a top mirror layer with a third refractive index.

12. A method according to claim 11, wherein the first refractive index is greater than the second refractive index, and the first refractive index and the second refractive index are less than the third refractive index.

13. A method according to claim 10, wherein the one or more patterned regions are etched all the way through the first material layer.

14. A method for forming a resonant reflector for an optoelectronic device, the optoelectronic device having a top mirror, the method comprising:

etching a pattern in a top mirror layer of the top mirror, resulting in one or more patterned regions; and

providing a material layer over the top mirror layer including over the one or

more patterned regions.

15. A resonant reflector for an optoelectronic device, the resonant reflector comprising:

a first mirror region having a top mirror layer, the top mirror layer having one or more patterned regions that extend down into the top mirror layer but not all the way through, and one or more non-patterned regions; and

a second mirror region formed on selected non-patterned regions of the top mirror layer.

16. A resonant reflector according to claim 15, wherein the one or more patterned regions reduce the reflectivity of the resonant reflector in those regions.

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17. A resonant reflector according to claim 16, wherein the one or more patterned regions provide a phase shift.

18. A resonant reflector according to claim 16, wherein the one or more patterned regions are positioned to provide mode control to the optoelectronic device.

19. A method for forming a resonant reflector for an optoelectronic device, the optoelectronic device having a top mirror with a top mirror layer, the method comprising:

etching a pattern down into but not through the top mirror layer, resulting in one or more patterned regions and one or more non-patterned regions; and

providing a cap mirror above selected non-patterned regions of the top mirror layer.

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20. A resonant reflector according to claim 19, wherein the one or more patterned regions reduce the reflectivity of the resonant reflector in those regions.

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21. A resonant reflector according to claim 20, wherein the one or more patterned regions provide a phase shift.

22. A resonant reflector according to claim 20, wherein the one or more patterned regions are positioned to provide mode control to the optoelectronic device.

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23. A resonant reflector for an optoelectronic device that has an optical cavity with an optical axis, the resonant reflector comprising:

a resonant reflector layer extending across at least part of the optical cavity of the optoelectronic device, the resonant reflector layer having a reflectivity that does not abruptly change laterally across the optical cavity.

24. A resonant reflector according to claim 23, wherein the resonant reflector layer has a refractive index that does not abruptly change from a first refractive index to a second refractive index laterally across the optical cavity.

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25. A resonant reflector according to claim 24, wherein the refractive index of the resonant reflector layer includes contributions from a first material having a first refractive index and a second material having a second refractive index.

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26. A resonant reflector according to claim 25, wherein the first material is confined to a first region and the second material is confined to a second region, the first region and the second region co-extending along an interface, wherein at least part of the interface is not parallel to the optical axis of the optoelectronic device.

27. A resonant reflector according to claim 25, wherein the first refractive index is larger than the second refractive index.

28. A resonant reflector according to claim 27, wherein the first material is SiO_2 and the second material is Si_3N_4 or TiO_2.

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29. A resonant reflector according to claim 27, wherein the first material is AlGaAs and the second material is a polymer.

30. A resonant reflector according to claim 29, wherein the polymer is polyimide or Benzocyclobuthene (BCB).

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31. A resonant reflector according to claim 25, further comprising a mirror having a top mirror layer, the top mirror layer positioned adjacent to the resonant reflector layer.

32. A resonant reflector according to claim 31, wherein the top mirror layer has a refractive index that is greater than the first refractive index and the second refractive index.

33. A resonant reflector according to claim 32, wherein the top mirror layer is AlGaAs.

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34. A resonant reflector for an optoelectronic device that has an optical cavity with an optical axis, the resonant reflector comprising:

a resonant reflector layer extending across at least part of the optical cavity of the optoelectronic device, the resonant reflector layer having a first region with a first refractive index and a second region with a second refractive index, the first region and the second region co-extending along an interface, at least part of the interface being not parallel to the optical axis.

35. A resonant reflector according to claim 34, wherein the first region is positioned toward the center of the optical cavity and has lateral edges that are not parallel to the optical axis, and the second region has lateral edges that co-extend along the lateral edges of the first region.

36. A method for forming a resonant reflector for an optoelectronic device, the method comprising:

providing a first layer of material that is substantially planar;

providing and patterning a photoresist layer on the first layer of material;

heating the photoresist layer to cause it to reflow, resulting in a top surface of the photoresist layer that is non-planar;

etching the photoresist layer and the first layer of material to transfer the shape of the non-planar top surface of the photoresist layer to the first layer of material; and

providing a second layer of material over the first layer of material.

37. A method according to claim 36, wherein the second layer of material has a top surface that is substantially planar.

38. A method according to claim 36, further comprising the step of heating the second layer of material to cause it to reflow, resulting in a top surface that is substantially planar.

39. A method for forming a resonant reflector for an optoelectronic device, the method comprising:

providing a first layer of material that is substantially planar;

patterning the first layer of material;

heating the first layer of material to cause it to reflow, resulting in a top surface that is non-planar; and

providing a second layer of material over the first layer of material.

40. A method according to claim 39, wherein the second layer of material has a top surface that is substantially planar.

41. A method according to claim 40, further comprising the step of heating

the second layer of material to cause it to reflow, resulting in a top surface that is substantially planar.

42. A method for forming a resonant reflector for an optoelectronic device, the method comprising:

providing a first layer of material that is substantially planar;

patterning the first layer of material, resulting in lateral edges that extend up to top corners;

providing a photoresist layer over the patterned first layer of material, including over the lateral edges and top corners, the photoresist layer being thinner near the top corners;

etching the photoresist layer and the first layer of material, the etching step etching through the photoresist layer near the top corners first, resulting in the top corners of the first layer of material being etched more than regions away from the top corners; and

providing a second layer of material over the first layer of material.

43. A method according to claim 42, wherein the second layer of material has a top surface that is substantially planar.

44. A method according to claim 43, further comprising the step of heating the second layer of material to cause it to reflow, resulting in a top surface that is substantially planar.